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# A NEW SPECIES OF *CRYPTANTHA* (BORAGINACEAE) FROM THE SIERRA DE SAN PEDRO MÁRTIR, BAJA CALIFORNIA, MEXICO

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Abstract

**Cryptantha martirensis** M. G. Simpson & Rebman is described as new, being endemic to high elevations of the Sierra de San Pedro Mártir of Baja California, Mexico. It is sparse to common in the understory of coniferous woodland and in montane arroyos, slopes, and ridges in sandy to gravelly granitic substrates. This new species is similar to *C. muricata* (Hooker & Arnott) A. Nelson & J. F. Macbride in having nutlets with a shallow, dorsal ridge. It differs from the three recognized varieties of *C. muricata* in having a combination of tall and virgate primary stems with short and clustered inflorescence units; stems with mostly appressed and a few sparse, fine, spreading trichomes; a small corolla limb; and relatively large nutlets with dorsal tubercles that are low, rounded, and few per area. Quantitative evidence justifying these differences is summarized.

Key Words: Baja California, Boraginaceae, *Cryptantha*, *Cryptantha martirensis*, *Cryptantha muricata*, Mexico, Sierra de San Pedro Mártir.

Upon observing all known specimens of what had been identified as *Cryptantha* sp., *C. muricata* (Hooker & Arnott) A. Nelson & J. F. Macbride, or *C. muricata* var. *denticulata* I. M. Johnst. from high elevations of the Sierra de San Pedro Mártir, Baja California, we noticed several distinctive differences between these plants and any other *Cryptantha* species, including *C. muricata* and its known varieties (see below). We propose that these differences are sufficient to recognize these populations as a new species of *Cryptantha,* utilizing a taxonomic (morphologic) concept (Cronquist 1978, 1988) in which taxa are circumscribed based on the discontinuity of features.

## Taxonomy

**Cryptantha martirensis** M. G. Simpson & Rebman, sp. nov. (Figs. 1–4). —TYPE: MEXICO, Baja California, Sierra de San Pedro Mártir, SE of Vallecitos and approximately 3 mi (4.8 km) s of the Observatory, along the highest ridge en route to Pedro's Dome (Fig. 4), conifer forest with *Pinus jeffreyi, Abies concolor, Eriogonum wrightii* var. *oresbium, Philadelphus microphyllus,* and *Hesperocyparis montana*, mostly granitic substrates, 2630 m elev., 31.00803°N, 115.43591°W, 30 September 2008, *J. Rebman 15993*, with V. Marshall and M. Dykens (holotype: SD; isotypes: BCMEX, RSA, SDSU, UC).

**Plant** a terrestrial, annual, herb. **Root** a taproot, staining herbarium paper purple in some specimens. **Primary** stem erect, virgate, 35–70 cm tall, giving rise to several, elongate, inclined secondary (lateral) branches, those near the base often very thin; stem trichomes ca. 0.5–1.5 mm long, whitish, thin, tapered, straight to slightly curved, mostly appressed, a few sparse, fine horizontal to ascending, all often with minute bulbous base. **Leaves** simple, basal and cauline, sessile, spiral; basal leaves narrowly oblanceolate, 12–30 mm long, withered at anthesis; cauline leaves narrowly oblanceolate to linear, 15–40 mm long, 2 mm wide; all leaves with similar vestiture on both surfaces, trichomes ca. 1 mm long, whitish, thin, tapered, straight to slightly curved, inclined to appressed, those near leaf apex often with prominent, white, swollen base surrounded by tessellated rosette of often whitish, radially-oriented cells. **Inflorescence** unit a tightly clustered (often spheric) to elongate scorpioid cyme, 5–10 mm long, arising at nodes along length of primary axis or apex of primary and lateral branches, often with subtending inclined to reflexed, straight to recurved bracts, similar to cauline leaves. **Flowers** ebracteate, inclined to appressed, pedicellate. **Pedicels** ca. 0.5 mm long. **Calyx** appearing valvate at maturity, basally synsepalous, ca. 3.0 mm long, adaxially glabrous, abaxially hirsutulous along lobe margins and scattered on surface, trichomes straight to slightly curved, mostly appressed to ascending (ca. 0.5–2 mm long), midrib raised/ridged, hirsute, bearing straight, mostly inclined, bulbous-based bristles ca. 1–1.8 mm long. **Calyx lobes** lance-ovate, narrowly acute. **Corolla** rotate-salverform, sympetalous, white, tube ca. 1.5 mm long, limb ca. 1 mm wide. **Stamens** uniseriate, 5, epipetalous,

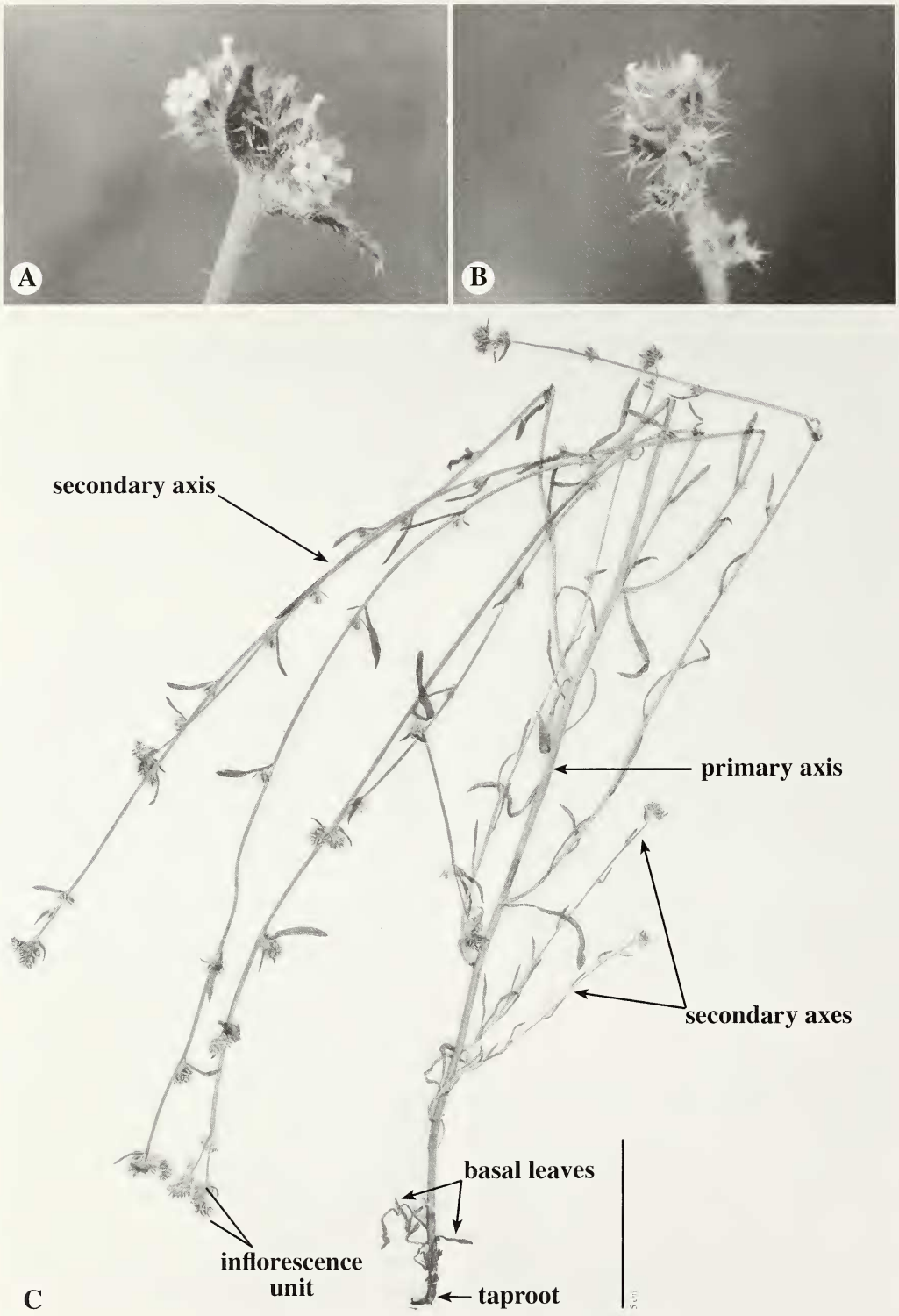


FIG. 1. *Cryptantha martirensis*. A–B. Photographs in native habitat (*Rebman 16022*). A. Inflorescence unit in flower. B. Inflorescence unit in fruit. C. Pressed specimen (*Rebman 15993,* type specimen), showing elongate (virgate) primary axes and short inflorescence units.

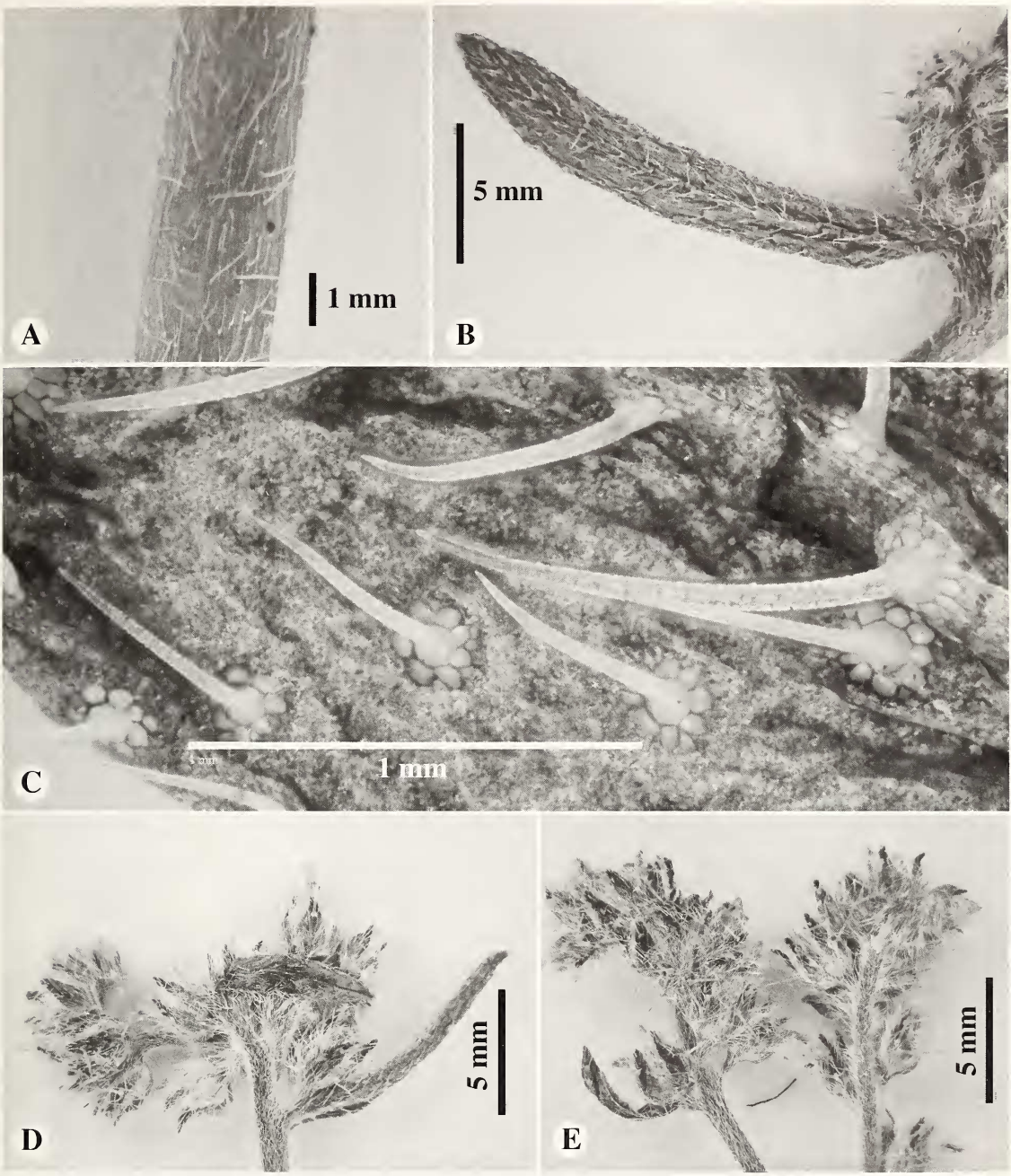


FIG. 2. *Cryptantha martirensis* (*Rebman 15993,* type specimen). A. Aerial stem close-up, showing thin, tapered, straight to slightly curved, mostly appressed trichomes. B–C. Inflorescence unit bract, similar to cauline leaf. B. Whole view. C. Close-up, adaxial surface, showing tapered trichomes with swollen base surrounded by tessellated rosette of radially-oriented cells. D. Inflorescence unit, in flower. E. Inflorescence unit, fruiting stage.

whorled, alternipetalous, distinct. **Gynobase** 4-flanged, narrowly oblong to oblanceolate in outline, ca. 1.4 mm long. **Style** terete, slightly ridged, ca. 0.7 mm long beyond gynobase, slightly surpassing fruit at maturity. **Stigma** minute, sub-capitate. **Fruit** a schizocarp of usually 4 nutlets with the surrounding calyx accessory. **Nutlets** 1.8–2.0 mm long, 1.2–1.4 mm wide, light tan-gray to brown, mottled, ovate, base truncate, margin angled (ca. 45°) in cross-section, sometimes slightly ridged and/or minutely tuberculate or scalloped, apex acute, ventral surface papillate and sparsely tuberculate, dorsal surface densely papillate and sparsely to moder-

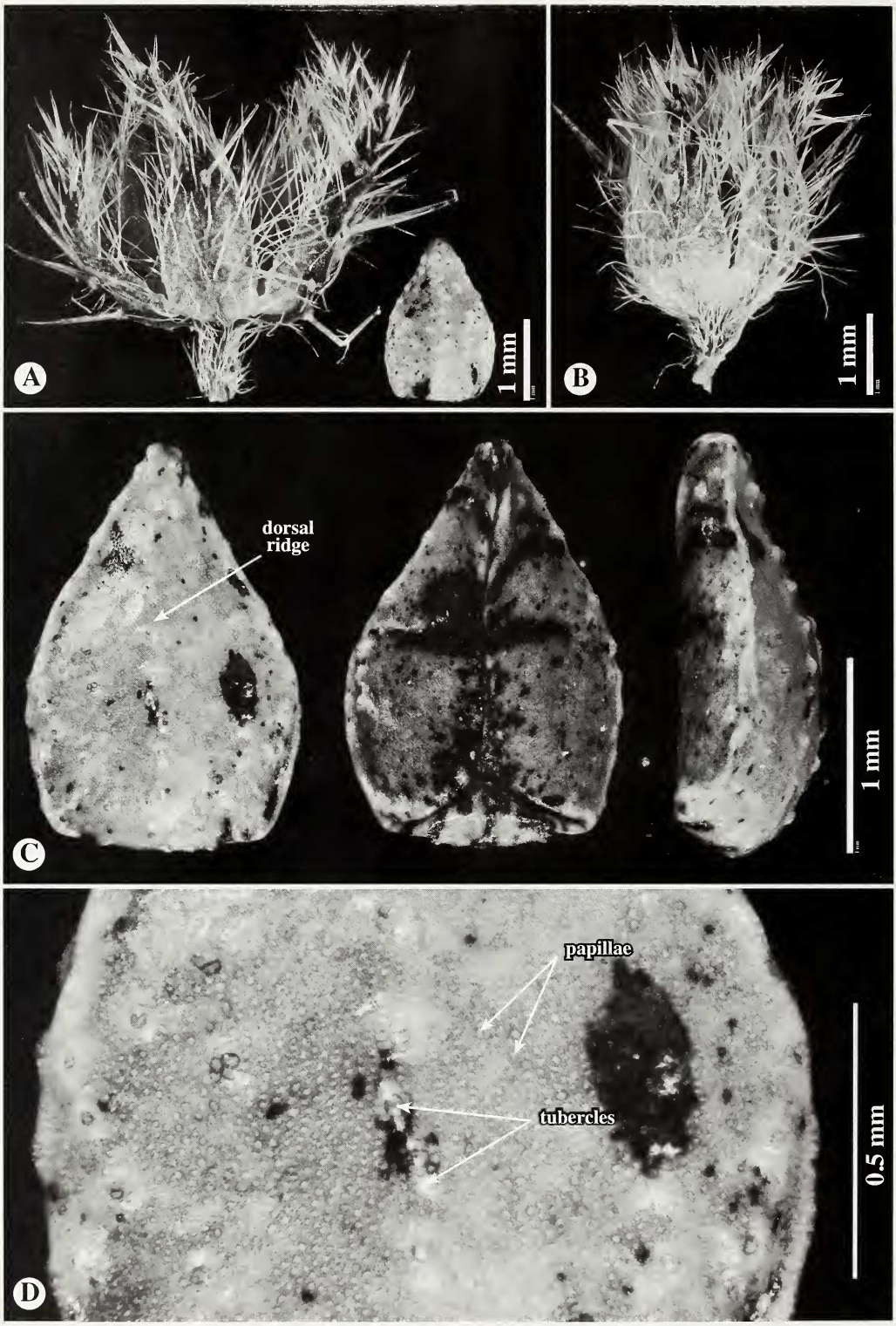


FIG. 3. *Cryptantha martirensis*. A. Calyx in fruit, with one of four nutlets (*Rebman 16022*). B–D. (*Rebman 15993*, type specimen). B. Calyx in fruit. C. Nutlet, in dorsal (left), ventral (middle) and lateral (right) views. Note dorsal ridge. D. Nutlet dorsal surface, close-up. Note numerous papillae and low tubercles.

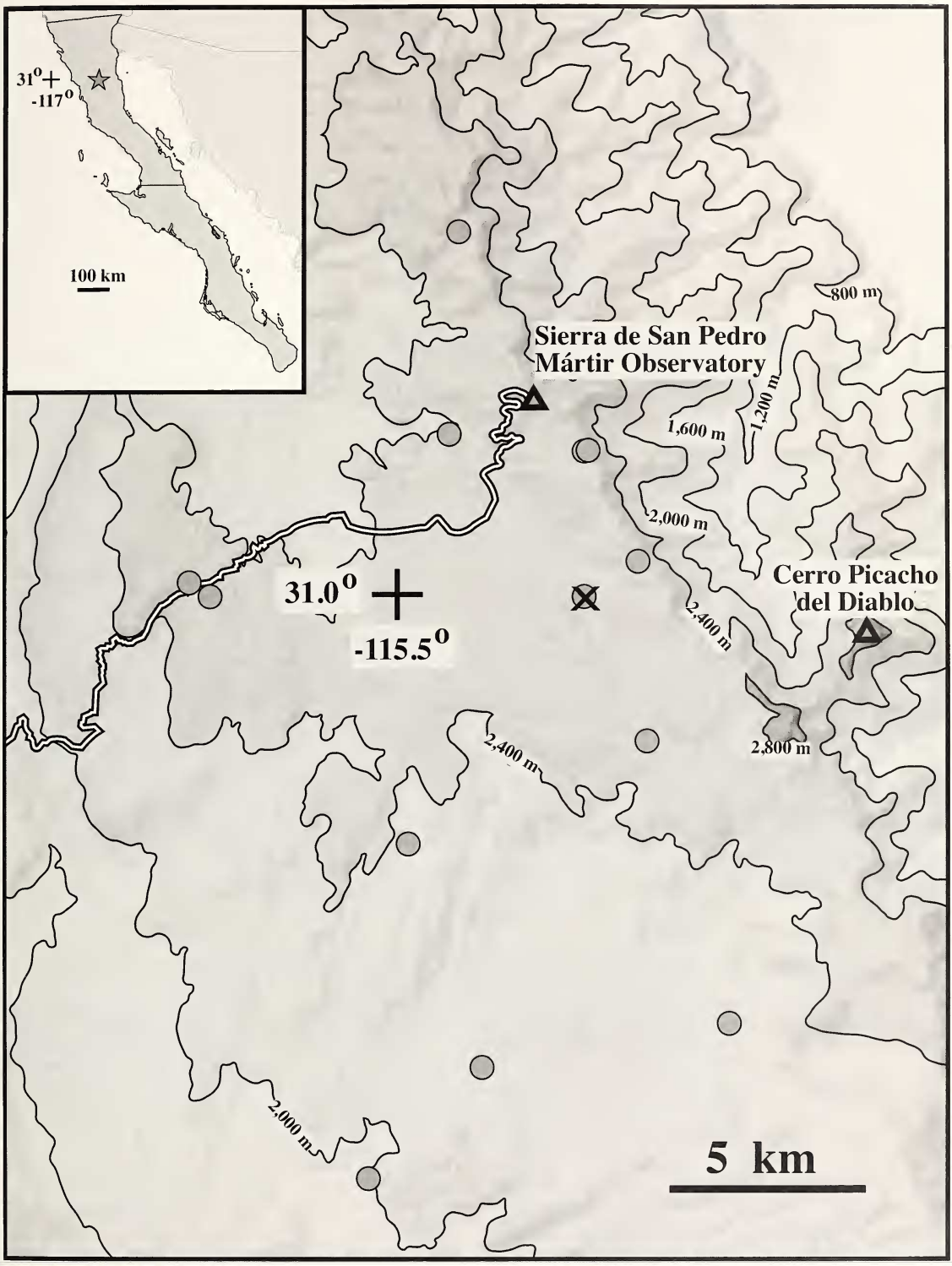


FIG. 4. Map showing the geographic distribution of the 13 known collections (circles) of *Cryptantha martirensis* from the Sierra de San Pedro Mártir. Locality indicated with "X" is that of the type specimen, *Rebman 15993*.

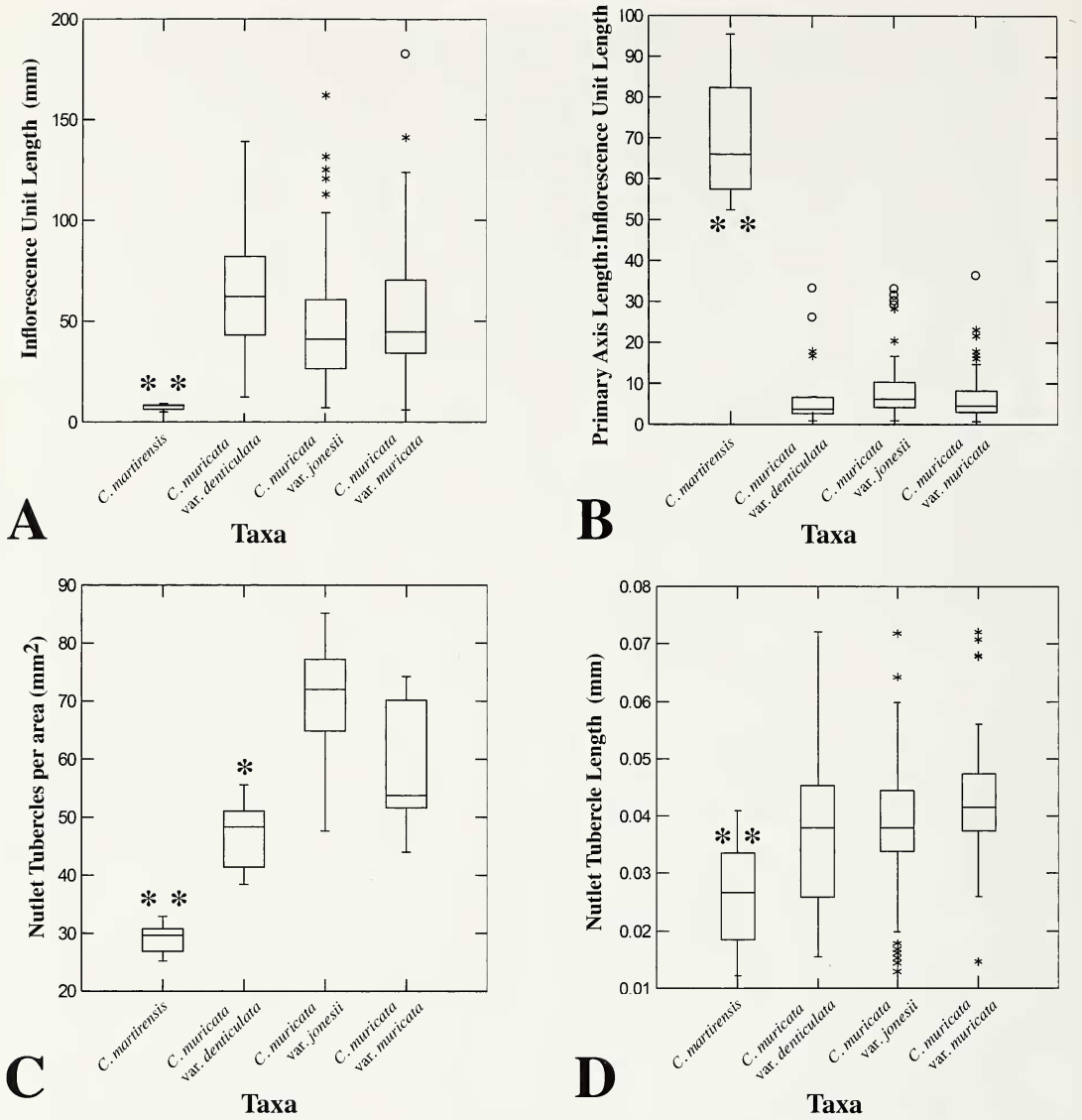


FIG. 5. Box plots of single characters, comparing *C. martirensis* with the three varieties of *C. muricata*. A. Inflorescence unit length (mm), that of *C. martirensis* significantly shorter ($P < 0.01$). B. Ratio of primary axis length:inflorescence unit length, that of *C. martirensis* significantly greater ($P < 0.01$). C. Nutlet tubercle number per area, dorsal face, that of *C. martirensis* significantly smaller ($P < 0.01$). D. Nutlet tubercle length, that of *C. martirensis* significantly smaller ($P < 0.01$), but with overlap of range. Note: box plots show median (middle horizontal line), first and third quartiles (lower and upper horizontal lines, respectively), and the range of the data outside the first and third quartiles (vertical lines). Outliers represented by "x," "*," and small circles. Statistical difference between a given taxon and all other taxa (via ANOVA Tukey post hoc test) is indicated as: ** = $P < 0.01$, * = $P < 0.05$ (probability that difference between groups due to chance alone).

ately tuberculate (tubercles denser at apex); median ridge present, low (obscure), often lighter-colored, sparsely tuberculate; ventral groove narrow, closed near apex, slightly open below, 2-forked at base, forks horizontal to slightly reclined; groove borders prominent, rounded, slightly up-curved basally. See Figs. 1–3.

*Cryptantha martirensis* is similar to *C. muricata* and varieties, differing in having a combination of elongate, virgate primary stems; axes with mostly appressed and a few sparse, fine, spreading trichomes; small corollas (limb ca. 1 mm wide); short (5–10 mm long) inflorescence axes; and relatively large (1.8–2.0 mm long) nutlets with dorsal tubercles that are low, rounded, and relatively few per area.

*Cryptantha martirensis* is found in usually sandy or gravelly soil and/or soil and rocks of granitic origin. Most records describe it in the understory of conifer or mixed conifer forest

(*Pinus jeffreyi, Abies concolor*, occasionally *Populus tremuloides*) with mixed shrubs and herbs (including *Ceanothus cordulatus, Eriogonum wrightii* var. *oresbium, Salvia pachyphylla, Silene laciniata*, and *Symphoricarpos* sp.), although some records describe the habitat as an arroyo, meadow margin, slope, or summit ridge. The species is cited as being scarce to common in different localities and habitats. *Cryptantha martirensis* is known only from high elevation (1900–2800 m) locations in the Sierra de San Pedro Mártir of Baja California, Mexico. Plants flower from as early as May to as late as early August and develop mature fruits from June to September.

The specific epithet, *martirensis*, is after the Sierra de San Pedro Mártir, ("mountains of Saint Peter the martyr"), to which this species is endemic. The suggested common name for the species is the Sierra de San Pedro Mártir cryptantha.

Paratypes (all from the Sierra de San Pedro Mártir and arranged alphabetically by collector; see Fig. 4 for map of localities): MEXICO, Baja California, Yerba Buena, scarce, in sandy soil of arroyo, 31.00°N, 115.45°W, 2500 m elev., 16 August 1967, *Moran 14161* (SD 79684); Los Llanitos, 30.967°N, 115.433°W, 2550 m elev., 17 August 1967, *Moran 14272* (RSA, SD 79685); La Grulla, scarce, under pines, 30.893°N, 115.478°W, 2100 m elev., 22 August 1967, *Moran 14493* (SD 79676); east slope of Cerro "2828", on east rim, occasional on east slope, 31.033°N, 115.45°W, 2800 m elev., 24 August 1968, *Moran 15412* (SD 68921); north slope of Cerro "2828", occasional in gravelly soil, 31.033°N, 115.45°W, 2800 m elev., 14 September 1968, *Moran 15624* (SD 69127); south summit ridge, Cerro Venado Blanco, occasional in gravelly granitic soil, 31.083°N, 115.483°W, 2750 m elev., 15 September 1968, *Moran 15635* (SD 69098); El Alto de Corona, fairly common under pines, 31.00°N, 115.55°W, 2400 m elev., 28 July 1970, *Moran 17909* (SD 76440); La Víbora, Arroyo la Grulla 4.0 km SW of La Grulla, occasional in sand by stream, 30.867°N, 115.508°W, 1900 m elev., 10 August 1977, *Moran 24465* (SD 97701); La Tasajera region, SW of Observatory, approx. 7 mi (11.3 km) S of the Observatory Road, *Pinus jeffreyi, Abies concolor, Populus tremuloides*, granite rocks and sand, annual, flowers white, 30.94389°N, 115.49722°W, 2285 m elev., 15 September 1998, *Rebman 5569* (SD 152066); along the road to Venado Blanco, N of Vallecitos and the main road to the Observatory, conifer forest with *Pinus jeffreyi, Abies concolor, Eriogonum wrightii* var. *oresbium, Silene laciniata*, and *Symphoricarpos*, annual, flowers white, rare. 31.03694°N, 115.48556°W, 2400 m elev., 29 September 2008, *Rebman 15973* (SD 191478, SDSU 18625); in vicinity of the campground along the road to Proyecto Condor approximately 0.25 mi (400 m) NE of the SSPM office and formal entrance, about 4 mi (6.4 km) W of Vallecitos and about 6 mi (9.7 km) SW of the Observatory, conifer forest with *Pinus jeffreyi, Abies concolor, Ceanothus cordulatus, Salvia pachyphylla*, and *Eriogonum wrightii* var. *oresbium*, mostly granitic substrates, annual, common, 31.00302°N, 115.55461°W, 2500 m elev., 30 September 2008, *Rebman 16022* (SD 191477); La Encantada, about rocks at margins of meadow, 30.9030°N, 115.4116°W (lat./long. estimated from locality data), 2200 m elev., 18 September 1930, *Wiggins 4880* (SD 67578).

## Taxonomic Relationships

*Cryptantha martirensis* appears to be a close relative of *Cryptantha muricata* (Hooker & Arnott) A. Nelson & J. F. Macbride, Botanical Gazette 61:42, 1916, a species of subtribe Cryptanthinae (Hasenstab-Lehman and Simpson 2012) of the Boraginaceae. *Cryptantha muricata* occurs in California, Nevada, and Arizona in the U.S. (Kartesz 2011; Kelley et al. 2012) and in Baja California and Sonora of Mexico (BajaFlora 2012; SEINet 2012). This species is the sole member of section Muricatae (Johnston 1925; cited in Abrams 1951). Johnston diagnosed section Muricatae as "Nutlets 4, verrucose or coarsely tuberculate, triangular-ovate, decidedly homomorphous, back obtuse, and bearing a suggestion of a medial ridge, with sides evidently angled and beaded; style usually surpassing the nutlets though rarely only equaling them." Given that *C. martirensis* also has four homomorphic nutlets per fruit that are tuberculate with a medial ridge, we propose that it may be tentatively placed in section Muricatae; however, molecular phylogenetic studies are needed to verify the monophyly of this group.

Johnston (1925) treated *C. muricata* as having three, intergrading varieties (a view upheld in recent treatments, e.g., Kelley et al. 2012): var. *denticulata* (Greene) I. M. Johnston, var. *jonesii* (A. Gray) I. M. Johnston, and var. *muricata*. Variety *muricata*, which is found mostly in the central-western mountains and Transverse Ranges of California, is distinctive in having a large corolla limb, a stout and well-differentiated central (primary) aerial stem axis, and relatively large nutlets with a sculpturing that is muricate (having radially elongate, rounded processes that are longer than broad, accounting for the epithet name, *muricata*). Variety *denticulata*, which occurs in higher elevation regions of the Sierra Nevada, Tehachapi, Transverse, and White/Inyo mountains of California, and in western Arizona and Nevada, differs in having primary and secondary axes not well differentiated, a small corolla, and large nutlets with generally low, rounded tubercles (with rounded processes shorter

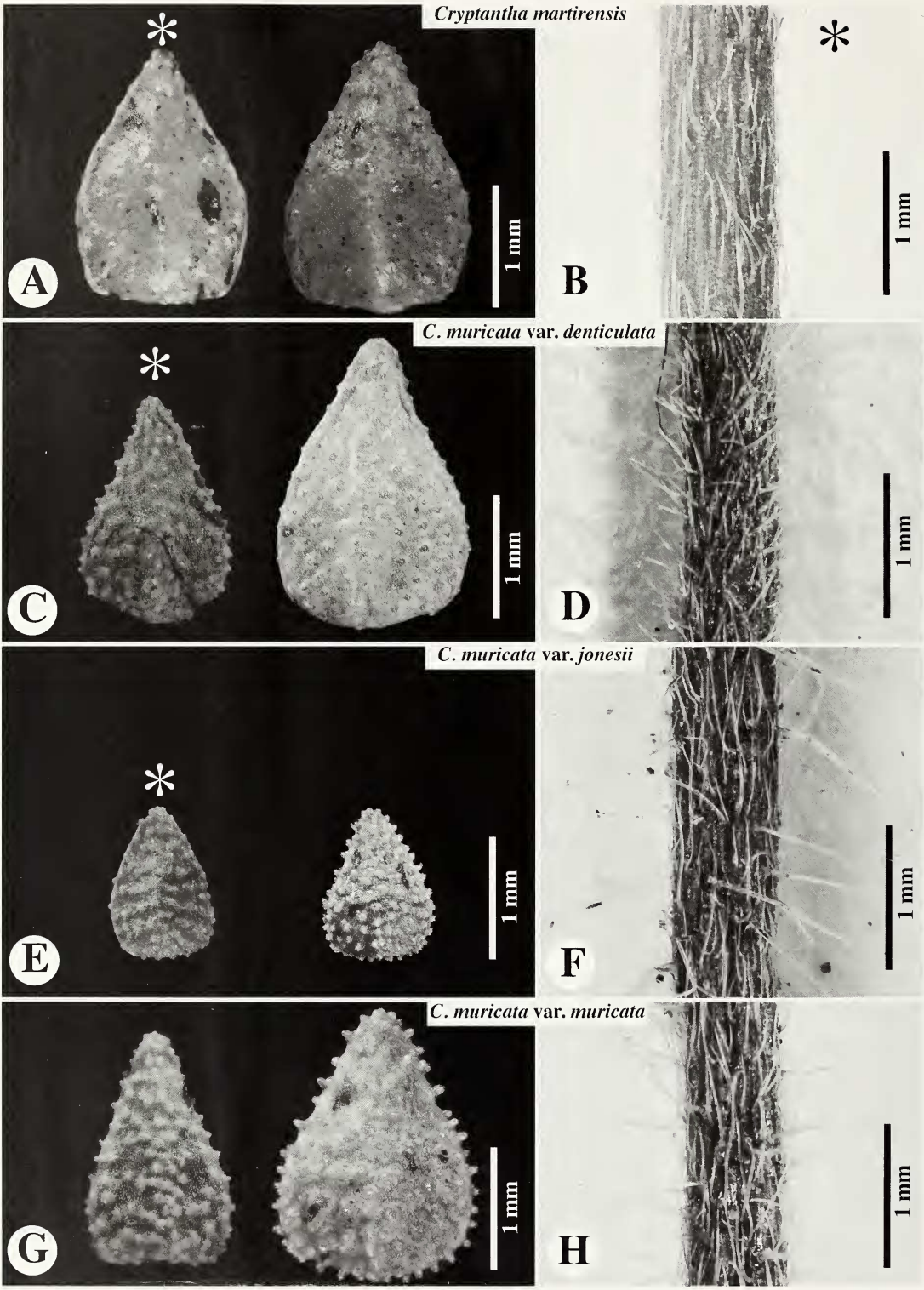


FIG. 6. Comparisons of nutlets and inflorescence axis of investigated taxa. A–B. *Cryptantha martirensis*. A. Nutlets (left = *Rebman 15993;* right = *Rebman 15973*). B. Inflorescence axis (*Rebman 15993*). C–D. *Cryptantha muricata* var. *denticulata*. C. Nutlets (left = *Curran s.n.,* CAS 123277; right = *Simpson 2910*). D. Inflorescence axis (*DeDecker 3354*). E–F. *Cryptantha muricata* var. *jonesii*. E. Nutlets (left = *Jones 79* [GH 97680]; right = *Howe 996*).

than broad). Variety *jonesii*, which occurs in the North and South Coast Ranges, Transverse and Peninsular ranges and adjacent coastal areas, the eastern Sierra Nevada foothills of California, western Arizona, and as far south as the central desert of Baja California, resembles var. *muricata* in aerial stem morphology but resembles var. *denticulata* in corolla size and has nutlets that are usually smaller than either variety with a muricate sculpturing (Kelley et al. 2012).

## Quantitative Analyses and Classification

Specimens of *Cryptantha muricata* and *C. martirensis* from herbaria at IRVC, RENO, RSA-POM, SBBG, SD, SDSU, UC-JEPS, and UNLV were studied as part of a larger project (Simpson et al. unpublished; Appendix 1) evaluating the taxonomic validity of the recognized varieties of this species. Twenty-three specimens of *C. muricata* var. *denticulata*, 97 specimens of *C. muricata* var. *jonesii*, and 83 specimens of *C. muricata* var. *muricata*, and eight of the 13 known specimens of *C. martirensis* were included in this larger morphometric study. A statistical analysis of primary axis length, inflorescence unit length, corolla width, nutlet tubercle length, and nutlet tubercle number dorsal face (both per nutlet and per area of the dorsal face) was conducted. To visualize character distributions by taxon, box plots showing the median and the four quartiles of distribution were prepared for these characters. Each of these was evaluated for statistically significant differences by taxon using analysis of variance (ANOVA), with multiple comparisons made between the taxon means using the Tukey post hoc test. Taxa that were statistically different from all other taxa in a particular character are indicated as such (at probabilities $<0.01$) in the box plot diagrams. All statistical analyses were performed in SYSTAT, Version 11 (Systat Software, Inc., San Jose, CA).

Qualitative observations and quantitative measurements from all known populations of *C. martirensis* confirm that the species is distinctive in the length of the inflorescence unit (a scorpioid cyme), which in *C. martirensis* is significantly shorter ($P < 0.01$) than the three varieties of *C. muricata* (Fig. 5A). *Cryptantha martirensis* has an elongate primary axis, but this is not significantly longer than other varieties (not shown). However, the correlated ratio of primary axis:inflorescence unit length in *C. martirensis* is significantly greater than the three varieties of *C. muricata* (Fig. 5B). Nutlet length of var. *martirensis* overlaps with those of the other three varieties (not shown), although *C. muricata* var. *jonesii* tends to have smaller nutlets. However, both the number of tubercles per area (Fig. 5C) and the nutlet tubercle length (Fig. 5D) of *C. martirensis* is significantly smaller than that of the three *C. muricata* varieties, the former without and the latter with overlap of range.

We considered treating this new taxon as a variety of *C. muricata*, given its similarity in nutlet morphology, being four per fruit, homomorphic, tuberculate to muricate, and with a median ridge. *Cryptantha martirensis* does resemble and overlap with varieties of *C. muricata* in several features. The branching pattern of *C. martirensis* is similar to that of *C. muricata* vars. *jonesii* and *muricata*, although the primary (and often secondary) axes are generally longer and thinner, being more virgate ("wand-like"). The range of corolla size of *C. martirensis* is very similar to that of *C. muricata* vars. *denticulata* and *jonesii*. Nutlet size of *C. martirensis* is very similar to that of *C. muricata* vars. *denticulata* and *muricata*. However, *C. martirensis* is distinctive from the varieties of *C. muricata* in having: 1) a significantly shorter inflorescence cyme unit, with no overlap (Fig. 5A, B); 2) nutlets with significantly fewer tubercles per area (Fig. 5C) and significantly shorter tubercles, though overlapping with those of *C. muricata* var. *denticulata* (Fig. 5D; see Fig. 6); and 3) stem axis trichomes mostly appressed, with qualitatively sparser and finer spreading trichomes (Fig. 6). We believe that these three distinctive morphological features of *C. martirensis*, along with its isolated geographic distribution having no known intergradation with *C. muricata*, warrant its species status by a taxonomic (morphologic) species concept (Cronquist 1978, 1988).

We speculate that *C. martirensis* may represent the descendant of a past relictual population or the product of long-distance dispersal. Its isolation in the Sierra de San Pedro Mártir region has perhaps resulted in barriers to gene flow and the evolution of a unique combination of morphological features. However, we know nothing about the phylogenetic relationships within this complex; that is the goal of future molecular studies.

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F. Inflorescence axis (*Boyd 6316,* SBBG 101675). G–H. *Cryptantha muricata* var. *muricata*. G. Nutlets (left = *Smith 4697*; right = *Simpson 3034*). H. Inflorescence axis (*Simpson 3034*). * = Type specimen. (Note: the type specimen of *C. muricata* var. *muricata,* D. Douglas *s.n.* (GH 00097575) is immature and lacks nutlets.)

Taxonomic Key to *Cryptantha Martirensis* and Varieties of *Cryptantha Muricata* (modified from Kelley et al. 2012)

1. Corolla limb 3–8 mm in diameter . . . . . ***C. muricata*** var. ***muricata***
1′ Corolla limb 1–3.5 mm in diameter
   2. Nutlets 1.1–1.3(1.9) mm long, muricate, tubercles generally elongate . . . . . ***C. muricata*** var. ***jonesii***
   2′ Nutlets 1.8–2.0 mm long, tuberculate, tubercles generally low, rounded
      3. Primary stem axis 11–53 cm long, not obviously different from secondary axes; inflorescence unit, including stalk, 12–140 mm long. . . . . ***C. muricata*** var. ***denticulata***
      3′ Primary stem axis 35–68 cm long, prominent, elongate, virgate; inflorescence unit, including stalk, 5–10 mm long. . . . . ***C. martirensis***

## Geography

The geographic range of *Cryptantha martirensis* is one of the most restricted of any species of *Cryptantha s.s.* (*sensu* Hasenstab-Lehman and Simpson 2012), with known populations occupying an area less than 200 km$^2$ (80 mi$^2$; Fig. 4). Elevation range of specimen collections is 1900–2800 m. Wiggins (1980) cited *C. muricata* as occurring in Baja California but recognized no varieties for the species. Based on our current knowledge, *C. muricata* var. *jonesii* is the only variety of this species known to occur in Baja California, found in mountainous and coastal regions of the northwestern portion of the state to as far south as the central desert (BajaFlora 2012). In the Sierra de San Pedro Mártir region, we have discovered only one collection of *C. muricata* var. *jonesii* in an adjacent canyon (Cañón del Diablo) at a lower (1550 m) elevation (*Moran 25642*, 6 May 1978, SD 100241). Other *Cryptantha s.l.* taxa in this area include *Eremocarya micrantha* (Torrey) Greene var. *lepida* J. F. Macbride [*Cryptantha m.* (Torrey) I. M. Johnston var. *l.* (A. Gray) I. M. Johnston] and *C. simulans* Greene (Thorne et al. 2010; BajaFlora 2012).

The Sierra de San Pedro Mártir is a floristically diverse region of great botanical importance, having a natural fire regime and being the southern continuous limit of the California Floristic Province (Riemann and Ezcurrra 2007; Thorne et al. 2010). The higher elevations comprise the Parque Nacional Sierra de San Pedro Mártir, established in 1947. Thorne et al. (2010) reviewed the vascular plant flora of the "high" Sierra de San Pedro Mártir, defined as being greater than 1800 m in elevation. These authors cited 453 species native to this region. Of these taxa, 23 species and two varieties (including the recently described *Calyptridium parryi* var. *martirense*; see Guilliams et al. 2011) are endemic to the Sierra de San Pedro Mártir, slightly over 5%. To this we add yet another species, increasing the endemic flora of this interesting region.

## Acknowledgments

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## Appendix 1

### List of voucher specimens of *Cryptantha martirensis* and varieties of *C. muricata* examined for the morphometric analysis, in order by collector within each taxon.

***C. martirensis***: *Moran 14161* (SD 79684); *Moran 14272* (SD 79685); *Moran 15412* (SD 68921); *Moran 15624* (SD 69127); *Moran 15635* (SD 69098); *Rebman 15993* (SD 191476); *Rebman 16022* (SD 191477); *Rebman 5569* (SD 152066). ***C. muricata* var. *denticulata***: *Anonymous 1225* (SDSU 5401); *Batholomew s.n.* (SBBG 63779); *Clokey 7001* (POM 255821); *Clokey 7001* (RSA 19960); *Curran s.n.* (CAS 123277); *DeDecker 2988* (RSA 273709); *DeDecker 3354* (SBBG 47796); *DeDecker 3576* (RSA 618916); *DeDecker 4878* (RSA 620298); *DeDecker 5229* (RSA 624848); *Gross 1282* (RSA 699885); *Higgins 25402* (RENO 405345); *Honer 1218* (RSA 682027); *Honer 1245* (RSA 682014); *Honer 1275* (RSA 682033); *Honer 338* (RSA 682639); *Howell 40157* (RSA 595061); *Kennedy 1917* (RENO 13686); *Munz 15086* (POM 229454); *Secrest s.n.* (SBBG 37365); *Simpson 2908* (SDSU 17552); *Simpson 2910* (SDSU 17554); *Spalding s.n.* (POM 368165); *Tiehm 1754* (RENO 34423). ***C. muricata* var. *jonesii***: *Abrams 3418* (POM 156385); *Ackley* (SBBG 63609); *Anderson 43B* (SDSU 13783); *Beauchamp 3301* (SBBG 92221); *Beauchamp 3301* (SD 128345); *Betzler 502* (IRVC 277); *Betzler 502* (IRVC 27758); *Boughey 204* (IRVC 15122); *Boyd 4032b* (RSA 524238); *Boyd 6316* (RSA 543848); *Boyd 6316* (SBBG 101675); *Brandegee s.n.* (POM 64391); *Brandegee s.n.* (POM 71557); *Brandegee s.n.* (RENO 31260); *Brandegee s.n.* (RENO 31261); *Burch 8V96C* (SDSU 12174); *Cain 725* (SDSU 18490); *Chandler 2416* (SBBG 45326); *Chandler 2418* (SBBG 23094); *Chandler 2426a* (RSA 321805); *Chandler 2426a* (SBBG 22707); *Chandler 2632* (SBBG 25522); *Chandler 2656a* (SBBG 25484); *Clokey 5818* (RENO 15621); *Dearing 4851* (SBBG 6266); *Elvin 2695* (IRVC 28285); *Estrella 59* (SDSU 15671); *Fosberg 10679* (POM 338000); *Fosberg 10686* (UNLV 25687); *Gallup 224* (SDSU 5395); *Glenn 20* (RSA 656912); *Gross 1775* (RSA 711527); *Gross 1817* (RSA 711556); *Guilliams 312* (SDSU 17357); *Guilliams 357* (SDSU 17539); *Guilliams 366* (SDSU 17542); *Haid s.n.* (SBBG 34216); *Hardham 10430* (SBBG 19499); *Hardham 1389* (SBBG 109613); *Hasenstab 22* (SDSU 18328); *Hoffmann* (SBBG 63782); *Hoffmann* (SBBG 63808); *Hoffmann* (SBBG 63809); *Hoffmann* (SBBG 63810); *Hoffmann* (SBBG 63811); *Hoffmann* (SBBG 63776); *Hoffmann s.n.* (SBBG 63807); *Howe 1522* (SDSU 5407); *Howe 4700* (SDSU 5411); *Howe 996* (SD 27675); *Howe 996* (SDSU 5422); *Johnston s.n.* (RSA 499834); *Jones* (SBBG 63778); *Jones 3405* (POM 71371); *Jones 79* (GH 97680); *Jones 79* (GH 97681); *Jones s.n.* (POM 71537); *Karnes 71* (SDSU 16304); *Karnes 71* (SDSU 16305); *Kraebel s.n.* (SBBG 11222); *Lauri 404* (SDSU 16714); *Marsh s.n.* (IRVC 19460); *Marsh s.n.* (SDSU 5413); *Myrick 833* (SBBG 28428); *Parish 11118* (RSA 499713); *Piehl 63544* (SBBG 19075); *Pollard s.n.* (SBBG 37255); *Reed 4124* (POM 96629); *Reiser 4-II-88* (SDSU 14567); *Roberts 5787* (IRVC 28143); *Roos 4732* (RSA 662061); *Ross 2854* (RSA 525098); *Sanders 26481* (IRVC 26327); *Sanders 6537* (UNLV 23020); *Sanders 9036* (UNLV 30634); *Simpson 12III88C* (SDSU 5428); *Simpson 2263* (SDSU 19322); *Simpson 2462* (IRVC 30815); *Simpson 2462* (SDSU 17210); *Simpson 2790* (SDSU 19296); *Simpson 2794* (SDSU 17573); *Simpson 2885* (SDSU 17512); *Simpson 2894* (SDSU 17551); *Simpson 3822* (SDSU 18310); *Smith 4786* (SBBG 83057); *Smith 8323* (SBBG 83070); *Spalding s.n.* (RSA 499833); *Taylor 17263* (JEPS96822); *Thorne 38079* (RSA 633326); *Thorne 52830* (RSA 309664); *Tucker 2720* (RSA 115221); *Twisselmann 9930* (SBBG 21646); *Wheeler 2527* (RSA 611443); *Whittaker SJ-2* (IRVC 283); *Whittaker SJ-28* (IRVC 279); *Whittaker SJ-345* (IRVC 276); *Zabriskie s.n.* (SBBG 53352). ***C. muricata* var. *muricata***: *Beauchamp 2265* (SBBG 92228); *Blakley 4036* (SBBG 13155); *Blakley 7340* (SBBG 85224); *Blakley 7341* (SBBG 85223); *Boyd 9395* (RSA 599821); *Boyd 9554* (RSA 599530); *Boyd 9820* (RSA 600065); *Chandler 2426a* (SBBG 22803); *Chandler 2475* (SBBG 22915); *Chandler 3671* (RSA 535943); *Chandler 3671* (SBBG 97609); Clokey 5667 (RENO 15620); *Davidson 2810* (RSA 499708); *Denslow 1084* (RSA 679206); *Donahue* (RSA 499693); *Douglas s.n.* (GH 97575); *Gross 442* (RSA 660818); *Hardham 12750* (SBBG 107289); *Hardham 18247* (SBBG 109273); *Hardham 918* (SBBG 106802); *Hardham 995* (SBBG 106799); *Hasenstab 31* (SDSU 18343); *Helmkamp 5496* (IRVC 28175); *Hoffmann* (SBBG 63786); *Hoffmann* (SBBG 63787); *Hoffmann s.n.* (SBBG 63781); *Hoffmann s.n.* (SBBG 63788); *Hoffmann s.n.* (SBBG 63793); *Hoffmann s.n.* (SBBG 63795); *Hoffmann s.n.* (SBBG 63796); *Hoffmann s.n.* (SBBG 63798); *Hoffmann s.n.* (SBBG 63799); *Hoffmann s.n.* (SBBG 63800); *Hoffmann s.n.* (SBBG 63801); *Hughes 7855* (SBBG 119335); *Johnston 1950* (POM 3905); *Johnston s.n.* (POM 7910); *Jones s.n.* (POM 72218); *Junak 4211* (SBBG 94000); *Marsh s.n.* (IRVC 19457); *Meinke 352* (UNLV 25262); *Mulroy 2979* (IRVC 22526); *Mulroy 3625* (IRVC 21516); *Niles 4752* (UNLV 37537); *Niles 4795* (UNLV 37585); *Philbrick s.n.* (SBBG 42677); *Pollard s.n.* (SBBG 63785); *Purer 6553* (SD 39203); *Roberts 4939* (RSA 599646); *Ross 2499* (RSA 517128); *Ross 3512* (RSA 597275); *Ross 3520* (RSA 597266); *Ross 3772* (RSA 597401); *Ross 3914* (RSA 567176); *Ross 7628* (RSA 578276); *Ross 7685* (RSA 578246); *Ross 7941* (RSA 580301); *Ross 8038* (RSA 579449); *Ross 8440* (RSA 596019); *Ross 8521* (RSA 596911); *Sanders 21993* (IRVC 28524); *Sanders 25987* (IRVC 26334); *Sanders 26051* (IRVC 26363); *Sanders 26095* (IRVC 28379); *Sanders 26609* (IRVC 26233); *Simpson 3034* (SDSU 19185); *Simpson 3035* (SDSU 19186); *Smith 1127* (SBBG 85060); *Smith 1569* (SBBG 6265); *Smith 1983* (SBBG 95323); *Smith 3658* (SBBG 85063); *Smith 4037* (SBBG 85062); *Smith 4697* (SBBG 85061); *Smith 5565* (SBBG 85056); *Smith 6096* (SBBG 85050); *Smith 6392* (SBBG 86451); *Smith 983* (SBBG 6262); *Swinney 7281* (RSA 730260); *Thompson 3178* (IRVC 4840); *Twisselmann 12985* (SBBG 28572); *Wheeler 754* (SBBG 45092); *White 7855* (RSA 674776); *Whittaker SJ-13* (IRVC 281).